

Richmond Refinery LPS Bulletin – Reliability

HNC F-1551 DeNOx Module Plugging



IMPACT ERM:

Loss ID 33388

Location: Hydroprocessing Division, RLOP - Heavy Neutral Cracker (HNC)

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DeNOx Module Dirty Inspection.

Note an almost complete coverage of the inlet surface area of fine fibers.



Example of material found on inlet face to DeNOx shown to be matted together following the contours of the catalyst clusters.

Tenets of Operations Violated:

Tenet 10 – Always involve the right people in decisions that affect procedures and equipment.

Incident Description:

Beginning January 31, 2012, operations had to reduce feed at the RLOP Heavy Neutral Hydrocracker (HNC) to approximately 17.0 - 19.75 MBPD against the planned rate of 20.0 MBPD due to a positive draft in the HNC furnace cluster. Process engineering supplied data showing the pressure drop across F-1551 DeNOx catalyst module (a part of the common flue gas system) has been increasing since the 4Q11 Major T/A. As the pressure drop increased, the draft indication on the HNC distillation furnaces began to read positive, creating a potentially unsafe condition. To keep the furnace in negative draft and within permit allowable NOx emissions, HNC feed had to be cut.

Investigation Findings:

- 1) Procedures did not address protecting the inlet face of the DeNOx module for plant start-up.
- 2) Trending of DeNOx degradation and plugging was viewed/analyzed for a one-year time period, which seemed to indicate sufficient run length capabilities. However, a longer review of the long-term history (i.e., a longer time span) of this issue indicated something to the contrary.
- 3) Manufacturing does not have a DeNOx (SCR) best practice that provided information regarding long term asset strategy recommendations.

Lessons Learned / Business Practices:

- 1) Significant debris was found (which was believed to have come from plant start up) were directed through the DeNOx, which caused plugging.
- 2) Equipment with a single point of vulnerability for a unit should be analyzed for degradation in alignment with the shutdown frequency interval in order to help better predict the probability of failure.
- 3) DeNOx plugging has occurred in other facilities in a similar manner.

What Worked Well:

- 1) Operations made necessary plant moves to alleviate the potentially unsafe condition of F-1550 operating in positive draft and remain within Title V NOx limits.
- 2) Furnace stack excess O₂s were reduced which helped reduce the corrected NOx calculation.
- 3) Hydro combined maintenance team quickly planned and executed a plant slump to remove the plugged DeNOx module and replace it with a new one with zero incidents or injuries.

Recommendations:

- 1) Modify start-up procedures to protect DeNOx module from debris.
- 2) Adjust the timing of the performance analysis of DeNOx modules so that they are aligned with the shutdown frequency/schedule.
- 3) Generate a DeNOx Best Practice to provide recommendations and help share experiences through the Manufacturing system.